rapid changes of wind and weather associated with the cyclonic systems.

The most constant and steady of the earth's surface wind belts is that of the trades, and on this account they might be looked upon as the mainspring of the circulation [5] of the atmosphere to which the other wind systems, lower and upper, not so immediately related to equatorial heating, adjust themselves. In relation to equatorial low pressure the trade winds represent a balance of cause and effect, for while in the initial processes of the circulation these winds are set blowing to supply the defect of pressure over the heated equatorial region, in the final adjustment they develop and maintain the low pressure through the effects of the earth's rotation. All land regions in both Hemispheres, subjected more or less throughout the year to the influence of this system of winds, are reduced to desert conditions except the windward slopes of mountain ranges which obstruct the path of the currents. But although fairly steady and regular over extensive areas, the trade winds vary their limits greatly with the seasons and with the nonperiodic changes connected with day-to-day weather. In Europe, as already indicated, the northward extension of the trade system causes the normal summer drought of the Mediterranean Basin, and when, as occasionally happens, the same system, as represented by the Atlantic HIGH, pushes unusually far north, weeks of very trying summer drought are likely to be experienced in England. This brings out the importance of studying the average wind system in relation to the deviations of the momentary circulation from the normal standard pattern.

Again, the July or winter mean chart for Australia shows that country to be dominated by an expansion of the oceanic HIGHS of those latitudes, and the effect is to weaken somewhat the southeast trade along the east coast. But it has been shown that Australian [6] winter weather is made up of the passage of a series of anticyclones traveling around the globe from west to east, the system keeping south of the continent during the summer months. Clearly, then, what looks a stationary HIGH on the average chart is due to the passage of these traveling anticyclones with tongues of low pressure between them. The systems travel, apparently, in the direction of the upper westerly current. The important point, however, to note is this: that the limits, strength, and structure of the southeast trade wind in the Australian region must vary greatly from day to day in accordance with the position of the controlling anticyclones. The fact is that the trades, as well as the other wind systems, which look such solid realities on charts of mean wind and pressure, are apt to become rather elusive shadows on charts of particular circulation and difficult to identify except over quite restricted areas. And this demonstrates the supreme importance of investigating the particular day-to-day phases of the circulation in such a manner as to identify and locate them, whether normal or abnormal, in the general structure of the stable circulation as represented on the average charts. It is necessary so to coordinate momentary structures of the circulation with the average stable structure that, when pronounced distortions or even complete subversions of the latter occur, it may be possible to trace the steps by which the balance is upset. It should never be forgotten that the momentary circulation—that is, the disposition of the air currents with respect to particular center of high and low pressure—is the actual process by which the interchange of air between the Equator and the Poles is day by day effected; and that it is owing to these momentary turbulent deviations from the stable steady flow as represented on mean charts, that we get our daily weather changes with all their momentous consequences in the economy of the earth. If there were no such departures from the steady flow, an inevitable result would be, for example, that over large parts of the globe it would absolutely never rain at all, whilst over others an almost continuous drizzle would fall; in other words there could be none of the daily weather changes associated with the actual unsteady, turbulent circulation of our experience.

One may conclude these observations with an illustration, from the equatorial belt, of the importance of studying actual day-to-day conditions in order to get at the root of the climatological problems. Some years ago there was a discussion in the *Geographical Journal*, of London, as to whether the moisture which supplied the southwest monsoon rains of the mountains of Abysinnia came from the Indian or the Atlantic Oceans. The mean wind and pressure charts throw little light on the problem, and the very existence of such a controversy is a hint that both views are partly correct. But a knowledge of the daily disposition of the air currents, whose average structure we generalize under the term "southwest monsoon," would reveal what proportions of the moisture may be attributed to each of the two ocean reservoirs.

It might be noted, further, that the nearly rainless coast of Somaliland is an almost unique feature in the rainy equatorial belt. The explanation is no doubt this, that in consequence of the immense monsoonal disturbances due to the Asiatic Continent this coast is at no season the place where opposing currents from the northern and southern trade systems converge. The heavy conventional equatorial rains seem to be conditioned by such convergence.

Enough has, perhaps, been said in this paper to show that studies of climatic factor No. 5 must proceed with the particular or actual momentary phases of the circulation of the atmosphere, if the science of climatology is to be fully developed on geophysical lines.

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CLIMATE AND VEGETATION OF THE HIGH PAMIR.[1]

[Excerpts from a review in *Nature* (London), April 28, 1921, pp. 270–274.]

The term "Pamir," when strictly used, connotes the level floor of a wide-based mountain valley in the uplands that connect the Hindu-Kush and Karakoram Ranges to the south with the Alai and Tiananshan Ranges to the north. On its eastern side this tract rises rather abruptly from Kashgar; westward it descends more gradually to Ferghana. * * *

The climate of this region is rigorous, for the winters are long. July and August are the only months when its plants grow and flower. Though the days are then mostly bright, and the thermometer, an hour before sunset on an August afternoon, may register 75° F., the temperature during the ensuing night may be 14° F., and even in July snowstorms occur. As a rule, however, bitterly cold winds blow day after day until sunset, and, even when the days are calm, brief but violent evening gales may sweep down the mountain slopes, carrying with them gravel and stones [hurricane air drainage.] At noon on an overcast August day the water welling from a hot

[5] See Blair, W. R., on planetary circulation, in MO. WEATHER REV. for April, 1916.
[6] See Lockyear, J. S.; Discussion of Australian Meteorology, 1909.

[1] On "The second Danish Pamir expedition. Conducted by Lieut. O. Olufsen. Studies in the vegetation of Pamir." Pp. ix-132. (Copenhagen: *Gyldendalske Bog. handel*, 1920.)